A Diſcourſe proving from Experiments, That the larger the Wheels *of a* Coach, *&c. are (cæteris paribus,) the more eaſily they may be drawn over a* Stone *or ſuch like obſtacle that lies in the way: by a Member of the* Philoſophical Society *of* Oxford.

HAving read in the Mechanicks of Merſennus[a], Herigon[b], and Dr. Wallis[c], *That the larger the Wheels of a Coach, &c. are, (cæteris paribus,) the more eaſily they may be drawn over a ſtone or ſuch like obſtacle that lies in their way;* I was willing to try ſome Experiments which I thought might convince ſome men better of the truth of it, then a Mathematicall demonſtration.

I therefore ordered a Modell of a part of a *Wagon* to be made, conſiſting of 4 wheels, 2 axes and a board nailed upon the axes. The leſſer wheels were $4\frac{1}{3}$ inches high, and the bigger wheels $5\frac{2}{3}$ inches high, *viz:* $\frac{1}{12}$ of the ordinary height of the wheels of a *Wagon:* The weight of the Modell was almoſt a pound and half. I had alſo 2 other wheels made $5\frac{2}{3}$ inches high to be put on inſtead of the leſſer. The middle of the 2 axes were $6\frac{1}{4}$ inches aſunder. All the wheels turned very eaſily upon the axes.

A piece of Lead $50\frac{3}{4}$ avoirdupois was laid upon the modell, ſo forward that the leſſer wheels ſeemed to bear above parts of the weight. Then the modell was drawn with a ſtring laid over a Pulley, the top whereof was $\frac{1}{4}$ of an inch higher then the top of the hinder axis;

[a] Geom. pa. 459 [b] Mec. pr. 16. Schol. [c] Mec. c 7. pr. 3 Schol. § 15.

and

and the middle of this Pulley was $7\frac{1}{2}$ inches from the middle of the fore-axis.

The leſſer wheels being put on, and the ſtring being tied to the top of their axis,

1. Three pound drew the modell on the ſmooth levell Table.

2. Twenty pound drew the leſſer wheels over a ſquared rod $\frac{1}{4}$ of an inch thick.

3. Thirty pound drew them over a round rod a little more then half an inch thick.

4. Thirty one pound drew them over a ſquare rod half an inch thick.

5. Twelve pound drew the hinder wheels over the bigger ſquare rod.

The ſtring being laid under the axis, *viz*: $\frac{1}{8}$ of an inch lower then before.

6. Twenty nine pound drew the leſſer wheels over the bigger ſquare rod.

Then the 2 bigger wheels being put on inſtead of the leſſer, and the ſtring lying over the axis.

7. Three pound drew the modell on the Table.

8. Twenty five pound drew the Fore-wheels over the round rod.

9. Twenty five pound drew them over the bigger ſquare rod.

10. The ſtring lying under the axis, ſixteen pound drew them over the leaſt rod.

11. Twenty three pound drew them over the round rod.

12. Twenty three pound drew them over the bigger ſquare rod.

13. Thirteen pound drew the hinder wheels over the bigger ſquare rod.

All theſe Experiments were tried twice at leaſt, and moſt of them 3 or 4 times over

In all of them the Lead was laid exactly upon the

ſame part of the board, but yet when the leſſer wheels were taken off, the Lead did not lean ſo much forward, ſo that the hinder wheels were ſomewhat more preſſed than they were before.

By comparing the 2d, 3d and 4th Experiments with the 10th, 11th, and 12th, it appears how much more eaſily a *Wagon*, &c. might be drawn in rough wayes, if the fore-wheels were as high as the hinder wheels, and if the thills were fixt under the axis. Such a *Wagon* as this would likewiſe be drawn more eaſily where the wheels cut in Clay, or Sand, or any ſoft Ground. And moreover high wheels would not cut ſo deep as low wheels, as *Dr. Wallis* does plainly demonſtrate [d]; beſides ſome other advantages which he mentions.

Low wheels are better for turning in a narrow Compaſs than high ones: But it ſeems probable that *Wagons* with 4 high wheels might be ſo contrived that there ſhould be no great inconvenience in that reſpect; at leaſt ſuch *Wagons* as ſeldome have occaſion to turn ſhort, as Carriers *Wagons* and ſuch like.

The difference which you may obſerve in the 8th and 11th Experiments, is agreeable to what is ſaid by *S. Stevinus* [e], and *Dr. Wallis* [f]; viz. *that if a Coach, &c. muſt be drawn over rough, uneven places, it is beſt to fix the Traces to the Coach lower then the height of the Horſes ſhoulders.* And therefore that is not the beſt way which ſome *Wagoners* uſe, who ſometimes putting their horſes in pairs, hook the chains of ſome of the Horſes to the cheſt of the *Wagon* higher then they need to do.

14. A Table 2½ foot long was ſet with one end 8½ inches higher then the other end, and the Model being loaded as before, leſs weight by 6 ounces drew it up the Table when the 4 bigger wheels were on, then when 2 bigger and 2 leſs were on.

d Mec. c. 7. pr. 3. Schol. §. 21. e Stat. l. 3. pr. 9. f Mec. c. 7. pr. 3 §. 36.

The

The reaſon of this is given by Dr. *Wallis* g and other Writers of Mechanicks: *viz.* becauſe in the firſt caſe there was almoſt the ſame direction of the motion of the Modell and of the ſtring that drew it; but not in the 2d caſe when the fore axis was ſo much lower then the top of the Pulley.

g Mech. c. 7. pr. 3. §. 36.